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SEA-SIDE ORNITHOLOGY.

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THE ornithology of our New England seaboard at the present day is very far from presenting either the interest, the variety or the sources of excitement, which, even within a single generation, were, from Long Island to Grand Menan, features so characteristic. If we go back yet farther, though only to a period within the recollection of that very respectable individual, "the oldest inhabitant," the changes from that recent period to what is now witnessed are yet more remarkable, and make our present poverty both striking and painful. Then wild-ducks are said to have nested on the outer Brewsters. Then, probably, the now exterminated *Alca impennis* was a bird of New England, as it was at some period, probably more distant, one of Massachusetts also. Then all our salt marshes and our lowlands near the sea swarmed, during the spring and autumn months, with plover, snipe, godwit, tatler, curlew, and wading birds of various forms and plumage. Then all of our estuaries, inlets, coves, bays, rivers and creeks along the entire coast, abounded in sea-fowl during the entire year, the only difference being that at certain seasons of the year, the resident species were driven by the ice and

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the severity of the winter to more open waters, where their numbers were immensely reinforced by myriads of sea-ducks from more northern seas, and which are so absurdly designated by fishermen and gunners as "Coots." The numbers of these wild-ducks, of various kinds, off our entire coast, according to tradition, appear to have been well-nigh fabulous. Then, too, all the islands along the entire coast abounded with several varieties of gulls and terns, some of which are no longer to be met with, and all in very greatly diminished numbers.

Now how changed the whole scene! Wild-ducks no longer breed on any portion of our entire coast. The exceptions are so very few that they only prove the too general rule. Here and there a few remote uninhabited islands aside from the haunts of fishermen, and remote from the tracks of commerce, afford to a solitary species of gull, and to the decimated terns a precarious retreat, where, late in the season, a few succeed in rearing their young, and thus in postponing the day of the final extermination of their race. For, so long as the Solons of our General Court encourage, by their legislation, their unchecked and wholesale destruction, the day cannot be far distant when these graceful and harmless birds will have become wholly, as they are now almost, a "bright vision of the past."

Thus, with the increase of population along the coast during the warmer months, when the portions least frequented at other times swarm with pleasure-seekers, and with the ceaseless activity with which every island is ransacked by the insatiate "toilers of the sea," the distinctive characteristics of our maritime ornithology has become very nearly destroyed. So many blanks and gaps now mar its symmetry, and dwarf its once fair proportions, that the subject loses nearly all the claims it would have presented half a century ago.

In speaking of what is left to us of the sea-side ornithology of New England, four or five groups suggest themselves

as still distinctive features. These are: the birds of prey chiefly found about the sea-coast; the smaller land-birds that are also maritime in their partialities; shore-birds or waders; sea-birds or swimmers; and occasional and winter visitants. As we do not propose to prepare such an article as Prof. Lowell would call "nothing if not a catalogue," and our limits do not permit an exhaustive sketch, we shall only briefly speak of those we regard as the most distinguishing characteristics of our seaboard, mentioning only a few that best typify these general divisions.

The birds of prey that seem to belong to our seaboard are not many, either in their variety of species or in the number of the individuals. Even the Fish-hawk, so marked a feature on the sea-coast of New Jersey, finds our rocky shores an uncongenial or an unprofitable field, and is seldom seen from Cape Cod to Cape Elizabeth. A few occur on both shores of Long Island Sound. From thence until we come to the mouth of the Kennebec, they are entirely wanting. The same is very nearly true of the White-headed Eagle. On the coast of Maine both of these birds abound, and their large and conspicuous nests, surmounting the tops of the loftiest pines, often in full view of the highway, are a noticeable feature in the landscape.

In the latter part of the summer and in the early fall, when the southward flight of many of the small birds has begun, the Barred Owls station themselves in ambush on the coast and among the inner islands, as if to forestall the gunners, who show them no mercy if they chance to meet them. Their noiseless flight and their inconspicuous plumage, so closely assimilating with the sandy dunes and rocky wastes, favor their success as marauders, and also their immunity from their rival hunters. The flight of the smaller waders and the young of the terns are their chief attraction at these times to the sea-shore.

Less than twenty years ago our shores abounded, in spring and fall, with the Rough-legged Buzzard. They frequented

the marshes and the edges of ponds in the lowlands near the sea, rarely going more than a mile or two inland. They appeared to hunt, by preference, for frogs, field-mice, and the smaller quadrupeds, and, more rarely, the smaller birds. For some unexplained reason their visits are now comparatively very rare. The Black-hawk, by some supposed to be only a darker race of this species, and once occasionally to be met with, is now unknown.

The Great-footed Falcon, though by no means confined to our coast, is yet a conspicuous feature to the sea-side whenever or wherever there are sea-fowl to attract him. But, with the ever increasing diminution of these attractions, this falcon now only pays us angel visits, except on the eastern coast of Maine.

In enumerating the conspicuous and characteristic features of our coast scenery, the crow must not be forgotten. Wherever muscles or clams can be dug at low water, or wherever a storm has thrown upon the shore an unusual accumulation of garbage, we find these sagacious wreckers on the alert, eager to gather their full share of the *flotsam* or *jetson*, as the case may be. Among our sea-side visitors, this invaluable but unpopular race are among the first to come, and the last of the migratory birds to leave our coast, and a few remain all winter.

The entire family of swallows, except the Purple Martin, are eminently sea-side birds; and most so, the White-bellied. In the eastern portions of Maine, and in all the islands of the Bay of Fundy, the abundance of this swallow is very remarkable. In Massachusetts they are far more abundant near the coast than in the interior. The Barn Swallow has been educated into resorting to the use of sheds, barns, porches, and eaves of houses for a nesting-place, yet we can remember when the rocks of Newport and Nahant were their primitive and natural breeding-places. The Cliff Swallows, since 1839, have become more and more abundant on our coast. The Sand Martin has ever been content to

occupy every convenient cliff, or river bank, or ocean front, in whose suitable soil it could excavate its necessary channel to a nest-hole.

Along the shores of Connecticut and Rhode Island, and occasionally on those of our own State, two interesting little *Ammodrami*, the sharp-tailed, and the sea-side *Finches*,—so called, in our poverty of terms to properly designate American forms having only a remote resemblance to that which they are intended to represent,—are species peculiarly characteristic of the sea-shore and peculiar to our own continent, there being two Atlantic and one Pacific varieties. Their elongated and slender bills distinguishing them from all other American sparrows, their long legs extending in the stuffed specimen beyond their tail feathers, their short lateral claws, their rounded wings and wedge-shaped tails composed of stiff lanceolate feathers, are all features eminently characteristic of sea-side life, and such as typify, only in a more marked degree, the true shore-birds. In fact in their habits they are not very unlike the true wader in many respects. Like them they feed upon marine insects and the smaller crustacea, keeping about the water's edge, walking upon the floating weeds and other substances raised by the tide, preferring this mode of life to a more inland residence, and only resorting to the uplands to feed upon grass and other seed when food fails them at the water's edge. They were once quite common on our northern shores, but, so far as the writer knows, a large proportion have disappeared, with other summer shore-birds, probably driven away by the gunners and pleasure-seekers who now frequent their former haunts. I have met with none, north of New Bedford, since 1840, although here and there in a few localities a few are yet to be found, as for instance, in the marshes of Charles River.

Closely allied to the *ammodrami* is the Swamp Sparrow, common to the lowlands of the sea-side, but not peculiar to them, and equally abundant in the lowlands of the interior, as far west as Wisconsin. It is found along our entire coast,

and is hardly distinguishable in its habits from the sea-side sparrows. The Savannah Sparrow, though only occasionally found breeding so far to the south as Massachusetts, is evidently a sea-sider, preferring the open dunes in the vicinity of the sea, and feeding chiefly on the grass and other seeds found in these wild and uncultivated places. Among the islands on the coast of Maine, as well as on the uplands bordering the sea-shore, it is a very abundant species. It nests in sunken places in the ground, often on the edges of cliffs, under cover of a projecting portion of the bank. In their habits they resemble the Song Sparrow, and their notes, though thinner and not so sweet, have many points of resemblance.

Another land bird, as yet quite rare and but little known, the Yellow-bellied Flycatcher,* so far as observed, is a bird affecting the sea-side. In the low marshy woods near Halifax, on the islands of Grand Menan over the water's edge, and on the banks of the St. Croix, in New Brunswick, these flycatchers have been observed and their nests obtained. That it is not exclusively a bird of the sea-shore would appear from the fact that it has been also obtained at the same season on the western shore of Lake Michigan. If found during summer on any part of our coast this side of Eastport, is as yet not ascertained.

The Belted Kingfisher, though chiefly an inland bird, and often found breeding in the interior, remote from any water, is still to be mentioned as one of the birds which, under favorable circumstances, enlivens the sea-side with his presence, his curious piscatorial habits, and his loud and rattling notes.

Leaving now the land forms that are characteristic of, or are found near the sea-shore, we pass to those water birds that may still be regarded as belonging to the maritime portions of New England. Of the Herons, five at least are summer residents near our sea-coast, breed within the

*The *Empidonax flaviventris*, though ranked as a *clamator*, or screamer, in modern systems, is actually a good singer, as is also the *E. Acadicus*, as Mr. J. A. Allen informs me, and, probably, also one or two other species of this genus.

marshy woodlands that skirt the ocean, and fish along the edges of creeks, in the more shallow water and pools of the marshes, or in the flats left bare by the receding tide. These are the Green, the Night, and the great Blue Herons, the Least and the Common Bittern. Three others, the smaller Blue Heron, the Snowy Egret, and the larger White Egret, in the calm weather of midsummer, are occasionally tempted to visit our coast. They are, however, only vagrant and adventurous individuals, and their visits are rare, accidental, and irregular. Nor are our resident species very abundant. The absence of large tracts of low swampy woods near the seaboard is not favorable to their protection or increase among us.

In the marshes and low swampy islands near the coast, occur in more or less abundance the Common Sora or Carolina Rail, the Virginia Rail, the American Coot, and the Florida Gallinule. The last two are not common, but both I am persuaded breeds with us, the evidence of which will sooner or later be made to appear by the actual discovery of their nests and eggs. The young of both have been obtained in our marshes in midsummer, and the Florida Gallinule has also been obtained near Boston in midwinter.

Of the true plovers only one, the Piping Plover (*Egialites melanotos*), is common to our sea-beaches during the breeding season. The Killdeer is found only in a few inland localities. The Golden, the Black-bellied, and the Ring Plover, are only spring and autumn visitants to our coast; and Wilson's Plover, if found at all, is only a vagrant wanderer that has been tempted to stray into a strange region. It does not belong to our coast, and if ever, is very rarely found. Once numerous on the beaches of Nantasket and Chelsea, but now nearly or quite driven from them, the Piping Plover is still found along the coast of Maine and in the less frequented portions of our own shore, and is one of their most interesting features. It is met with on the entire Atlantic coast, from Florida to the St. Lawrence, and is nowhere

more common than in the least frequented portions of Cape Cod. Although living in pairs, they are also a very social bird, and where undisturbed, several pairs usually select the same locality and live in friendly companionship, uniting in the fall with their young, in small flocks of twenty or thirty. They are found exclusively on sandy shores and low islands, and are never met with inland. They nest directly on the sand, relying directly upon their resemblance to it in the color of their plumage for their own safety and that of their eggs. Their young can run with remarkable celerity the moment they appear. At the approach of danger, or at the sound of an alarm-note from their parent, they will squat, in the most amusing manner, upon the sand, as still and motionless as so many little gray pebbles, and will almost suffer you to tread upon them before they will move. In the meanwhile the mother bird will be resorting to every imaginable form of lameness, or pretence of wounded disability, to draw you away from her young fledglings.

The common Spotted Sandpiper, though equally abundant throughout the interior, and found wherever there is any lowland, must also be mentioned as among our sea-side species. In many of its habits it strongly resembles our common plover, differing chiefly in its peculiar flight, the tilting motions of its tail and body, and its sonorous outeries of *peet-weet, peet-weet*.

The Turnstone is, with us, only a rare and occasional visitor, coming in semiannual migrations, but never giving us more than a transient visit. The Oyster-catcher, a Southern coast-bird and belonging chiefly to the regions south of Cape May, occasionally wanders as far north as Marshfield, and is entitled to this passing mention as one of the very remarkable forms, which, though very rare, are a very striking feature when present in the seaboard ornithology.

We pass, with mere mention, the Woodcock; the Upland Plover, and the Solitary Tattler, as properly upland and inland birds, and the whole family of *Tringidae*, or Sand-

pipers, Tatlers and Snipe, all of which are only autumnal and vernal visitants of the sea-coast. The time was when these constituted a much more marked feature of the maritime region than they now present, when the marshy ground, at certain seasons, seemed all alive with their countless flocks. But in these respects the times are sadly altered, never, in all probability to be improved. One species only deserves special mention, alike for its peculiar habits and its exceptional character. The Willet, the only representative of the genus *Sympheeria*, is found along our entire coast, as far to the north, certainly, as Halifax, N. S., where I have met with it breeding, finding its nest and eggs. Mr. Audubon was mistaken when he stated it was never met with east of Boston. It is a very shy and wary bird. Even when breeding it is usually very quiet when its nest is approached, until the eggs are about to hatch, or after the young have appeared. Then it becomes as remarkable for its clamor, and vociferates its loud cries of *pill-will-will-willet* with great emphasis and distinctness. The Willet breeds in the sandy marshes of Nantucket and its neighboring islands, constructing a well-made nest of woven wire-grass, and the eggs, quite large for the bird, are sharply pointed at one end, and are always placed with this end turned towards the centre of the nest. After the close of the breeding season they resume their shy and silent habits, and are sometimes known among sportsmen as "*humilities*." Their eggs, when fresh, are esteemed a great luxury where they are sufficiently common to be well known, as near Norfolk, Va.

Of the sea-fowl that now spend the warm season on our sea-coast, the list is not large and but little need be said. Vague traditions are all that now assure us that some six or seven species of sea-ducks once bred among the islands of Massachusetts. Except the Dusky Duck, which is an occasional exception, none of these now remain with us; only at the extreme eastern portions of Maine, the Eider Duck and the Red-breasted Merganser continue to construct their ex-

posed and often plundered nests. The Cormorants, two species of which once nested on our rocky cliffs, have long since left us. The Herring Gulls have all been driven as far east as Passamaquoddy. Only the Black-headed Gull, a Southern and somewhat rare species, and four varieties of Terns still breed on the islands off our coast. This gull (*Xema atricilla*) was formerly quite abundant along our entire New England coast, as far east as the Penobscot. It is now chiefly found on a few islands off Connecticut, near Nantucket, and on the coast of Maine, near St. George. It visits our coast late in May or early in June, and leaves us early in the fall, upon the first appearance of cool weather. Some twenty-nine or thirty years since two or three pairs were still breeding on Egg Rock, near Nahant, in company with the Wilson's Tern, but long since they have entirely disappeared. This gull, when its nest is disturbed, is very demonstrative in its protests, and its loud outeries of *há-há-há*, resembling loud peals of derisive laughter, are very remarkable and even startling in their singularity.

The Least Tern, the Arctic Tern, Wilson's Tern, and the Roseate Tern, still breed on our coast, and, except the last, along the entire coast of New England. The Roseate is chiefly confined to the neighborhood of Nantucket, and the southern coast of Connecticut. It once bred on islands near Beverly. The eggs of all these species are much sought for by the fishermen, and as they are rarely permitted to rear their young, the day of their final extermination cannot be far distant.

After midsummer our waters are visited for a few weeks by two species of Petrels, or Mother Carey's Chickens (*Thalassidroma Wilsonii* and *T. Leachii*). They are outsiders altogether, never visiting the land except during the breeding season. Where the former breed is still shrouded in mystery. They appear in our waters early in August, but where they come from, or where they remain eleven months in the year, "nobody mentions for nobody knows." The

other species, Leach's Petrel, breeds off the coast on nearly all the islands from Cape Elizabeth to Newfoundland, appearing in May and leaving in September.

Later in the season the open waters are visited by flocks of ducks, most of them known to the fishermen as "Coots." There are twelve or fifteen varieties, more or less common, which our exhausted space will not permit us to enumerate. Numerous as these may at certain seasons seem to be, they come now in decimated numbers, and are so severely hunted on their feeding grounds that but very few remain with us to spend the winter in our waters.

In midwinter the outer waters of our coast are frequented by several remarkable forms of sea-birds, combining several of the peculiarities of the albatross, the gull, and the petrel, and presenting a very singular and striking union of the more noticeable characteristics of each. They never appear with us near the land. They can therefore be only observed at a season of the year least favorable for marine explorations. Our knowledge of them must be therefore largely derived from the observations of unscientific persons who meet them in their winter fishery. They are classed by Mr. Lawrence in the tribe of *Longipennes*. Three belong to the family of Procellariidae, namely, the Fulmar or Fulmar Petrel, and at least two species of Shearwater Puffins. Others, called Skua Gulls, or Jagers, are placed among the *Laride*. Their habits are, however, as well as their forms, very different from those of the true Gulls. Four species of these Jagers, in company with several species of Gulls, spend their winter off our coast, and are to be met with there at no other time. The study of their habits, no doubt replete with as much of interest as of novelty, is still reserved for those students of science for whom the difficulties and the dangers of their investigations may give an added claim to their undertaking. Certainly we know of no species of our Atlantic coast-birds whose history is so much involved in doubt, or which promise more of interest in their investigations.

NOTES ON THE ARGONAUT.

BY W. H. DALL.



THE Argonaut, or Paper-sailor, is familiar to all who live in seaports; its elegant form and delicate texture making it deservedly a favorite ornament for table or mantel; and certainly nothing can be more exquisite than a perfect specimen of one of the larger species. It is of a snowy whiteness, with delicate undulating ridges, and the keel ornamented with a regular series of conical projections or tubercles, which near the spire are lightly touched with black. Perhaps its greatest charm is its perfect symmetry, in which it is only equalled by the pearly Nautilus which, however, it far surpasses in its sculpture, fragility and purity.

The Argonaut shell is formed, curiously enough, by the females only; as among more highly organized beings sometimes, the gentler sex outshine their brothers in the splendor of their apparel, and the extent it occupies. Unlike many, however, the Argonaut toils not, neither does she spin. Folding her arms about her, in her earliest infancy, she is speedily arrayed in all her glory, and has not shown any discontent at the old fashions since the time of Aristotle.

These animals are true cuttle-fish of the eight armed type. The male Argonaut is an insignificant shell-less creature, fond of retirement, solitary and rarely seen. When the tender passion seizes him, as he rocks on some sunny wavelet,* far from female society, he does not go in search of a wife, but with Spartan courage, detaches one of his eight hands (or arms) and consigns it to the deep, in the hope that some tender hearted individual of the other sex will fall in with it and take it under her protection. Thus for a long time the male Argonaut was unknown, the arm (which does not die when detached, but lives an independent worm-like life)

*The Argonauts have been observed floating on the water.

was, when found in the gill-chamber of the female, supposed to be a parasite, and was called *Hecto-cotylus*.

The shelly matter is secreted by the first pair, or dorsal arms, which are broadly expanded towards the ends, and also by the sides of the body, which are more closely connected with the shell than many naturalists have supposed. But there are no true muscular attachments as in other mollusca, of the animal to the shell.

I have seen fine specimens of Argonauta in the cabinet of Mr. Arnold, of Worcester, collected by himself; showing where the shell had been broken and repaired, the new layer in some places having been deposited by the sides of the body from the *inside* of the shell, and in others by the expanded arms from the outside. The anterior edges of these arms, however, seem to possess alone the power of secreting calcareous matter, as the fractures toward the spire were repaired with a deposit more membranous or horny than shelly.

The cuttle was, in more modern times, long supposed to have stolen its shell from some mollusk resembling Carinaria, known as the glassy Nautilus. The shell of Carinaria is very similar, taken by itself, to that of Argonauta straightened out, but it serves a totally different purpose. The Argonaut, separated from its shell, was described by Rafinesque as *Todarus*, he having described at the same time one of the large naked cuttles, as *Ocythoë*. According to his own account, his description being short and careless, the two were confounded. He says that the Sicilian fishermen call the Argonaut "*todaru*"; that the apex of the shell is blackened by a dark liquor which it emits, although it has not the ink-bag of the Sepias; and that the color of the eggs is black.

The animal was well known to the ancients as the inhabitant of its own shell, though they described it with poetical fancy, as sailing in pleasant weather on the surface, using its broad arms as sails, and the others as oars, and when the

sky became overcast, storm threatened or high wind arose, as drawing in its sails and seeking safety beneath the waves. It was the original "Nautilus," the pearly Nautilus being unknown to them.

The Argonaut swims rapidly by ejecting water through its siphon,—a large tube quite distinct from the mouth. This tube is placed just above the keel of the shell, and the large broad arms are always closely applied to the shell, though they can be slightly contracted. If the animal is removed from its shell, it cannot get into it again. It probably cannot form a new one for reasons already mentioned. Deprived of its protection, it beats itself about blindly till it dies.

The eggs have been said to be deposited *inside* of the spire. I think that this is a mistake. In the specimens I have seen, they are agglutinated to the outside of the apex, inside of the last whorl, as represented by M. Rang. (See Woodward's Manual, fig. 32.)

I believe the Argonauts are of limited distribution. Some extend over larger areas than others, particularly the Pacific species. But it is probable that when our knowledge of the subject is increased by a greater number of observations, we shall find that these beautiful creatures have their boundaries, outside of which they may rarely or never be found. Many species have been confounded, as the shells all closely resemble one another. *Argonauta argo* has been reported from the Mediterranean, to which it is strictly confined; from the Indian Ocean, Philippines, and even from California! For the last species I have proposed the specific name of *Pacifica*, as a comparison with Mediterranean specimens shows that, aside from the question of distribution, the shells differ. As an example of the probably limited distribution of these mollusea, I note as follows:

In 1849, M. Noury, captain of a French frigate, obtained a new and very distinct and beautiful Argonaut, from the whaling grounds off the coast of Peru, in Lat. 10° south. It

was described by M. Lorois in the "Révue et Mag. de Zoologie," in 1852, as *A. Nouryi*. Mr. Conrad, in his monograph of the genus, mentions that Capt. O. Swain, of Nantucket, in 1850, obtained a number of this species in the same vicinity. They were observed on the surface of the water on a perfectly calm day, when the sun was very hot. They appeared in large numbers, in one group at first, and then dispersed in smaller groups of twos and threes, moving with great rapidity over the surface. Approaching them with great caution, a number were secured. A year or two ago Capt. Dow, well known as an indefatigable collector, sent to the Smithsonian Institution two fine specimens captured in Lat. 10° south, Long. 90° west, almost the same spot whence they were originally obtained by M. Noury. So far as I am able to ascertain they have not been elsewhere detected. In one of them the ova, of a red color and very small, were agglutinated to the outside of the spire, as previously noted.

It is pleasant to add that our first detailed account of the Argonaut and its development, was published by a lady, Madame Power, who made her observations in the Mediterranean, having a sort of marine enclosure made, where she kept these animals and observed their habits from life.

ON THE PARASITIC HABITS OF CRUSTACEA.

BY A. E. VERRILL.

THERE are few subjects pertaining to the study of animals more curious and interesting than the various phenomena connected with the parasitism of certain species upon others. This subject is also one that has many important practical bearings, since our worst crop-destroying insects are kept in check mainly by insect parasites, feeding either on the eggs, the larvae, or the mature insect. Our domestic animals also,

and most quadrupeds, birds and fishes used as food, are afflicted, and often suffer greatly from parasitic insects, crustacea and worms; and even man himself is likewise the prey of numerous parasites, both external and internal, some of which, like the *Trichina spiralis*, often cause painful diseases and even death. But the subject has also a peculiar interest, when philosophically considered in connection with the varied phenomena of life and the theories of the origin of species. But at the present time it is our purpose merely to call attention to some curious facts concerning the habits of Crustacea, hoping that it may induce the readers of the NATURALIST to study more carefully the habits of this class, which, in this respect, is still very imperfectly known.

It is certainly singular that a very great majority of all animal parasites belong to the Articulate division of the animal kingdom, while very few are found among the Radiates, Mollusca, and Vertebrates.

The three great classes of Articulates each have numerous parasitic representatives. The external parasites of land animals are mostly Insects, and their internal parasites are Worms; but the external parasites of aquatic animals are mostly Crustacea, while their internal parasites are both Crustacea and Worms.

The class of Crustacea is naturally divided into three great groups, or subclasses. The highest, known as *Decapods*, have five pair of legs, hence their name, which signifies ten-footed. The lobsters and crabs are good examples. The next great group have seven pair of legs, or are fourteen-footed, hence their name *Tetradecapods*. The pill-bugs and sow-bugs are familiar land species. The lowest division, known as *Entomostraca*, have fewer mouth organs, and the legs are irregular in number and position, while the abdomen has no appendages and often amounts to a mere spine, as in the *Limulus*, or "Horseshoe Crab," which is a huge representative of the group, while most of the other species are quite small.

Although many of the Entomostraca, like Cyclops, Cypris, etc., are active and free swimming little creatures, which swarm in our ditches and ponds during summer, there are a great many forms that are true parasites, and infest fishes and other aquatic animals. These are mostly low and degraded species, in which the females become enormously developed, as compared with the minute males, and take on very singular shapes, losing, in many cases, by the progress of growth, all resemblance to their original form. In fact in some cases when mature they would scarcely be taken for Crustacea at all, had not their development been observed. Among these singular forms are a great number of genera which adhere to the external surface of fishes, and others to the gills and the membranes of the mouth. Lernea, and allied genera, are common upon various marine fishes. Penella, with its long quill-like body, lives on fishes. Clavella, which has also a very elongated form, lives upon the halibut; Trebius and Pandarus infest sharks, etc.; Caligus has numerous species which live on various marine fishes, and Argulus is common upon fresh-water fishes, and is also found on tadpoles. Prof. Dana, who many years ago carefully studied a species of Caligus* that lives upon the cod, states that it does not suck the blood, as had been supposed, and thinks that it feeds upon the mucus, as its mouth-parts are well adapted for that purpose. But Lernea, Penella, and their allies, adhere only by their proboscis, which is embedded in the skin, and often barbed with hooks, and probably serves to suck the blood. Some forms of Entomostraca allied to these, are internal parasites of serpents.

A very singular genus called Splanchnotrophus, lives as true internal parasites in various naked marine mollusca, on the British coasts. *S. brevipes* infests *Doto coronata* and *Eolis rufibranchialis*, while *S. gracilis* is found in *Doris pilosa* and *Idalia aspera*. Since some of these mollusca inhabit also the coast of New England, we may expect to

* *C. Americanus* Dana. American Journal of Science, Vol. 34, p. 225.
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find these or similar parasites. The male lives free in the visceral cavity, but the female is much larger and stationary, and as the ovaries develop, the clusters of eggs and tip of the abdomen project through the integuments of its victim. Another Entomostracan genus, *Doridicola*, contains small active species which are external parasites on the gills of similar mollusca.

The Tetradeacapods are not so often parasitic as the Entomostraca; yet many curious parasites of fishes, etc., belong to this division. The Isopod order, including the pill-bugs, and many aquatic species having a similar depressed form, contains more parasitic species than does the Amphipod order, which includes the compressed species.

Among the parasitic Isopods we find some curious species which live parasitically in the mouth of fishes, usually adhering firmly to the roof of the mouth by means of their numerous strong and sharp claws, and in that situation often grow so large as to almost entirely fill the mouth, causing no doubt a great amount of suffering to the helpless fish, and, perhaps, eventually its death by starvation. Such are the habits of certain species of *Livoneca* and allied genera, while other similar species live upon the exterior and in the gill-cavity, both of marine and fresh-water fishes. I have recently found an allied form in the stomach of a toad-fish from Florida, where it appeared to be truly parasitic. It was nearly an inch long and half as wide. *Nerocila*, *Anilocra*, and *Cymothoa*, are allied genera, including numerous species, all of which are parasitic on or in fishes. These genera have a more or less, oval or oblong, broad, stout, depressed body, with short crooked legs beneath, armed with sharp claws. Some of these species become three inches long and nearly an inch broad, and must be very annoying.

Another related group of Isopods includes *Bopyrus* and *Jone*, with allied genera, which are parasitic on other Crustacea. In these the males are small, and have the ordinary

Isopod form, but the female by excessive growth becomes five or six times as large, deformed in shape, and firmly adherent in the gill-cavity of its host, where it produces a deformity and enlargement of the carapax, looking like a large tumor. *Jone thoracicus* infests a species of Calianassa; *Bopyrus squillarum* victimizes a species of Squilla; and *B. Hippolites* infests various northern species of Hippolyte. It was observed last season by Mr. S. I. Smith and the author, at Eastport, Me., on *H. Sowerbyi*. Several other species are known having similar habits.

Among the Amphipods we find *Themisto* and *Hyperia*, parasitic on the large jelly-fishes of our coast, especially *Cyanea* and *Aurelia*. *Hyperia* is very common, and may be known by its large head and eyes and swollen body, which is usually of a dull reddish color. They live and breed in cavities that they themselves form in the disk of the jelly-fishes, by eating away its soft substance. They also live among the mouth-folds and ovarian lobes, often in large numbers and of all sizes; but they occasionally leave their victim for a time and swim freely in the water. Mr. Smith has reared our native species by feeding them on fragments of jelly-fishes, and ascertained that they undergo considerable changes, the antennae becoming shorter at successive moults, showing that some of the nominal species, based on the length of these organs, are merely stages of growth of one species. Several other parasitic Amphipods were observed by Mr. Smith and the writer, at Eastport. One small species with bright golden eyes lived in the interior of *Modiolaria lavigata*. Another pretty, pale-pink, smooth, red-eyed species was found repeatedly living parasitically in the stomach of our large Red Sea-anemone (*Urticina crassicornis*), but was seldom seen until the *Urticina* had been placed in alcohol, when several would often come forth and move about for a short time, but occasionally they were observed to come forth voluntarily, and after swimming about for some time would suddenly dart

into the mouth again, as if for protection! Nor did they seem to suffer any harm when caught and held for a long time in the grasp of the large tentacles of the anemone, as often happened, but when finally released were as lively as ever, and quite as willing to voluntarily enter the mouth. And yet the tentacles of *Urticina* are covered with myriads of powerful stinging organs, by means of which it can almost instantly kill various other larger crustacea, mollusca, fishes, etc., which are also quickly digested in its capacious stomach. The immunity that this species of Amphipod enjoys is evidently similar to that of *Hyperia*, which revels among and consumes the very powerfully armed, stinging tentacles of *Cyanea*, which so quickly kill most other small marine animals, and even severely sting the human skin. A pink-colored species of *Anonyx* was observed in immense numbers upon and in a species of sponge, upon which it appears to be parasitic, at least while young. The various species of *Caprella*, remarkable for their long slender bodies and legs, and their curious looping gait, recalling the motion of Geometrid larvae, appear to be parasitic on Hydroids and sponges. The Whale-louse (*Cyamus*) is allied to these, but has a short and broad body, with stout legs and claws, by which it clings to the skin in the manner of *Cymothoa* and other fish-lice.

The Decapod Crustacea afford, however, some still more curious instances, though they are seldom true parasites, if by this term we designate parasites that obtain their food at the expense of another by sucking its blood or absorbing its digested nutriment. But among the Decapods we find many species that are parasitic in or on other animals for the sake of shelter and protection, while in other cases there are such singular associations formed between two or more different species, that it becomes difficult to tell which is the host and which the parasite, or whether it may not be an arrangement for mutual benefit. Most persons have no doubt seen the little crab, with a smooth, rounded body,

that lives in the interior of the shell between the gills of the oyster, and is often cooked with that excellent bivalve. This is the *Pinnotheres ostreum* (Fig. 41), and is doubtless parasitic in the oyster merely for the sake of shelter, and probably does not injure the oyster unless by the irritation that its motions might cause. But it is doubtless an unwelcome guest, though the ancients had a notion that a similar species inhabiting the Pinna acted as a sort of sentinel by giving notice of danger, and thus warned the Pinna when to close. Hence its name, which signifies Pinna-guar-dian.

Another species, *P. maculatum*, lives in mussels (*Mytilus*) upon our coast. Another lives at Panama in a species of *Lithodomus*, a shell allied to *Mytilus*, but which is itself parasitic, and lives in holes which it excavates in other shells and corals. There are many other species of *Pinnotheres*, and allied genera, having similar habits. One fine species* lives in the Pearl Oyster (*Margaritophora fimbriata*) of the Bay of Panama. It often shares its secure pearly retreat with a curious slender fish, and with two other genera of Crustacea, very different from itself, resembling craw-fishes or miniature lobsters in form. The most common of these is a new species of *Pontonia*,† a genus previously known to be

Fig. 41.



* *Pinnotheres margarita* Smith, sp. nov., female. Body covered with a very short and close pubescence, looking very much like a uniform coating of mud. Carapax quite thick and hard, considerably broader than long, and strongly convex; cardiac region protuberant and separated from the branchial and gastric regions by a deep depression, which extends along the cervical suture to the hepatic region; front strongly deflexed, and with a slight median depression. Chelipeds very stout, the fingers acuminate and curved at the tips. Ambulatory legs rather stout; dactyli in the first three pairs short, curved, and pubescent nearly to the tips, except in the right leg of the second pair, where the dactylus is very long, almost straight, and wholly naked; in the posterior pair the dactyli are long, straight, slender and pubescent. Length of carapax, 11.8 millimeters; breadth, 13.8.

† *Pontonia margarita* Smith, sp. nov. Body and all the appendages smooth and naked. Carapex very broad, depressed; rostrum short, sharp and slender at the tip; a slender spine on the anterior margin at the base of the antennae. Eyes small, the cornea smaller than the peduncle. Flagella of the antennule short, the inner ones slender; the outer ones of about the same length, stout, fusiform. Anterior legs slien-

parasitic in the shell of *Tridaena*, of the East Indies, and in the large *Pinna* of South Carolina. Another genus, *Pinnixia*, allied to *Pinnotheres*, has two Carolina species. *P. cylindrica* Say, lives in the tubular burrow of a large worm, *Arenicola cristata*; the other, *P. Chaetopterana* St., lives in the strong tube of another large worm, *Chaetopterus parchmentaceus* St. Another allied form, remarkable for its nearly globose body and hairy legs, *Pinnaxodes Chilensis* Smith (*Fabia Chilensis* Dana), lives upon the coast of Peru and Chili in the shell of a small species of Sea-urchin (*Euryechinus imbecillus* Verrill), which it causes to grow out of shape. It appears to enter the anal opening when quite small, and retaining its position until fully grown, causes the intestine to dilate into a sort of cyst, and the anal area and upper part of the shell to become deformed. When fully grown it often fills nearly a third of the body of its host, and yet has but a small external orifice, out of which it probably cannot come, but the male, being much smaller, may readily enter. From the fact that nearly all the specimens of this Sea-urchin found thrown upon the beach, amounting to over one hundred, had this parasite, it is probable that it eventually weakens or kills its host by the irritation it produces.

Another very singular genus, *Harpalocarcinus marsupialis* St., lives among the branches of *Pocillipora cespitosa*, at the Hawaiian Islands, and by its constant motions while remaining in one spot causes the coral to grow up around itself so as to form as perfect and secure a residence as could be desired, while openings are left to admit water and food. I have observed similar cavities on *Pocillipora elongata*

der, hands small, about half as long as the carpus; legs of the second pair stout, the hands somewhat unequal and much longer than the carapax, much swollen, fingers compressed, their inner edges sharp, the dactylus slender, and with a single tooth in the middle fitting neatly into a corresponding notch in the propodus; succeeding legs slender and cylindrical, the dactyli very short and bi-unguiculate, the terminal unguiculus strongly curved, and a shorter one very much hooked at its base. Abdomen small, the first six segments slightly exceeding in length the length of the carapax. Length of body 20 to 30 millimeters.

from Ceylon, which are probably made by another species of the same genus. The genera *Trapezia* and *Tetralia* include small, smooth and polished, usually bright-colored crabs, which live free among the branches of *Pocillipora* and *Madrepora*. For this mode of life they are well adapted, both by their smooth, flat bodies, and by their peculiar feet, which are blunt at the end and furnished with sharp stiff spines to aid them in climbing among the coral branches. *Domecia hispida* has the same habits.

The Hermit or Soldier Crabs, are interesting in their habits, and well known to all sea-side naturalists. They always occupy the dead shell of some spiral Gasteropod, which they carry about on their backs, and into which they retreat when alarmed, holding it firmly by means of the long, spirally-curved abdomen, and by its hook-like appendages. But some species are apparently not satisfied with even this protection, and consequently induce certain species of Sea-anemones to dwell upon the shell they inhabit. The beautiful Sea-anemones belonging to the genera, *Adamsia* and *Calliactis*, are rarely found except in this situation. *Adamsia maculata*, of the European coast, attaches itself to the shell occupied by *Eupagurus Prideauxii*, near the inner lip, and spreads out its base laterally on each side until the lobes thus formed meet around the aperture and coalesce so as to form a complete ring, through which the crab emerges and retreats. The base of this *Adamsia* also has the unusual power of secreting a thin but firm pellicle, by which it extends the edges of the aperture of the shell, thus giving the crab more room, as it grows larger, and obviating the necessity of changing the shell, as other less-favored hermits are obliged to do. Several specimens of *Calliactis* usually occupy the same shell, and are not known to be capable of extending its aperture. All the species are very beautifully colored, and inhabit tropical seas. In the West Indies *C. bicolor* and *C. tricolor* are common, and one species occurs at Florida, while *C. variegata* occurs at Panama. *Cereus sol*

has the same habit, and occurs on the Carolina coasts. On our own shores the shells occupied by Hermit Crabs are usually completely covered by a beautiful little pinkish Hydrozoan (*Hydractinia polycelina* Agassiz), which at times extends the lip of the shell by its basal expansions. A still more curious instance of this kind is afforded by the *Gemmaria Americana* Verrill* (Fig.



Fig. 42.

Gemmaria Americana Verrill* (Fig. 42), a Zoanthoid polyp, allied to the Sea-anemones, but capable of budding from basal expansions, by which means it completely covers shells occupied by *Eupagurus pubescens*. After thus covering the shell, it is not only capable of extending the aperture by its own growth, but has the power of entirely dissolving and absorbing the substance of the shell so that no trace of it can be found, though the form is perfectly preserved by the somewhat rigid membrane of the polyp. This species has been found in deep water, off the coast of New Jersey, and in Massachusetts Bay.

Another still more remarkable case occurs in the China Sea. A Hermit Crab (*Diogenes Edwardsii* St.) found there has upon the outside of the large claw a circular, smooth space, upon which there is always found a small Sea-anemone (*Sagartia Paguri* Verrill). This appears to be an association for life, since very young crabs carry a very minute Sagartia, no larger than a pin's head, and large crabs have a large Sagartia. In this case when the crab retreats into its shell and folds down the large claw over the aperture, the Sagartia would appear to be attached within the aperture, and thus conceal and perhaps protect the crab. In all these and other similar cases, the advantage of association is doubtless mutual, for while the Sea-anemones, by means of their outspread tentacles, armed with stinging organs, of which fishes and other voracious animals have a wholesome

* Memoirs of the Boston Society of Natural History, Vol. I, pages 34 and 45.

dread, serve to protect the crab, the latter can more effectively travel about and seek food, and while tearing its prey into small pieces, many choice bits doubtless fall to the lot of its companion.

There is another group allied to the Hermits, the species of which often carry a valve of some bivalve shell upon the back for protection. At Florida and in the West Indies, *Hypoconcha arcuata* St., is found carrying a valve of Venus, or some similar shell, while at Panama *H. Panamensis* Smith* carries a valve of *Pecten ventricosus*, holding it on by means of the two posterior pair of legs, which are bent up over the back, aided by the posterior part of the body, which fits into the cavity below the hinge. An allied genus contains a species found from Florida to Brazil, *Dromidia Antillensis*, which carries upon its back, according to Dr. Stimpson, either a compound Ascidian or a Zoanthoid Polyp, but all the specimens in the Museum of Yale College carry a peculiar fleshy sponge, which fits upon and entirely covers the back, but is held in position by the four posterior legs. A peculiar genus of crabs, Dorippe, found on the coast of China, though not very nearly related to the two preceding, agrees with them in having the carapax broad and depressed, and in having the two posterior pairs of legs twisted up over the back, as if to hold on a bivalve shell, which may be their usual habit; but one of the species, *D. facchino*, was dredged at Hong Kong, carrying upon its back a beautiful Sea-anemone, *Cancrisocia expansa* St.,† which completely covers the back of the crab, and, like *Adamsia*, secretes from its base a thin, firm pellicle, to which it adheres, and by which the crab holds it in position with his four posterior

* *Hypoconcha Panamensis* Smith, sp. nov. Allied to *H. arcuata* Stimp. The carapax however, is narrower, the length equalling the breadth; the anterior margin not so regularly arcuate, and its edge broken by a marked median incision, and by distinct notches at the insertion of the antennae; the projection in the anterior part of the lateral margin much less abrupt and less prominent; the lower surface of the facial region sparsely granulated, the granules separated by smooth spaces; terminal segment of the male abdomen smooth. Length of carapax in a male, 17.5 millimeters; breadth 17.3.

† This species, as it appears expanded upon the back of the crab, has been figured in the Proceedings of the Essex Institute, Vol. vi.

legs. It appears that when very young the crab holds over its back a minute bit of shell or gravel upon which the Anemone lodges, and afterwards, by expanding its basal pellicle as the crab grows, provides it with a permanent protection. This Anemone was never found except upon the crab's back, and the crab was not found without it. A very different crab found at Panama, *Hepatella amica* Smith,* carries upon its back *Sagartia carcinophila* Verrill, but in this case the connection is probably less intimate, and not so permanent.

THE HALIOTIS, OR PEARLY EAR-SHELL.

BY ROBERT E. C. STEARNS.

THERE is a family of Mollusca whose beautiful shells are frequently seen ornamenting the parlor mantel or centre table, the admiration of all on account of the brilliant colors and iridescence of their pearly interiors.

These shells are popularly called Sea-ears, but the scientific name is *Haliotis*, from the Greek *halios*, marine, and *otis*, ear. In the different countries where these shells are found, there are local names by which they are known. In California the people call them *Abalones*, while they are called "*Meerohren* by the Germans, *Telinga maloli* or *Bia sacatsjo* by the Malays, and *Hovileij* by the Amboynese," according to Adanson. "The Eolians gave it the pretty name of *Venus's Ear*. It is the 'Mother-of-pearl,' or 'Nor-

* *Hepatella amica* Smith, gen. et., sp. nov. The genus *Hepatella* differs from *Hepatus* in having the carapax rectangular in outline, in the much larger facial region, the very small eyes and very short eye peduncles, and in wanting wholly the depression below the orbit; the carapax is also much thicker, and the lateral regions are concave above. In this species the gastric and posterior branchial regions are protuberant and granulous, as is also the middle of the cardiac region, the rest of the carapax smooth; the lateral margins nearly parallel posteriorly but rounded anteriorly, the edge thin and armed with about twelve irregular and sharp teeth; ambulatory legs very short and crested; the sternum deeply punctate and vermiculated, and the male abdomen very narrow, acutely pointed, and five jointed. Length of carapax, 11.5 millimetres; breadth 15.8.

man-shell' of old English writers; 'Ormier' (contracted from *oreille-de-mer*) of the French, '*Lapa burra*' of the Portuguese, '*Orecchiale*' of the Italians, and '*Patella reale*' of the Sicilians." The Cherbourg fish-women call it, according to Jeffreys, "*Si ieu*" (six yeux), from an idea that the orifices in the shells are real eyelets or peep-holes.

The shells of *Haliotis* are, through ignorance, frequently confounded with those of the *Meleagrina margaritifera*, or pearl-bearing oyster, which is the true mother-of-pearl shell, from which are obtained the beautiful pearls used in the manufacture of various articles of jewelry. The *Meleagrines* are bivalves, their shelly covering being composed of two pieces or valves, as is the case with the common oyster, scallop and clam, while the *Haliotis* has an univalve shell, complete in one piece or valve, without joint or hinge.

The *Haliotides* belong to the class *Gasteropoda* (*gaster*, belly, *poys*, feet), which comprises species of Mollusks that are characterized by their creeping upon, or by means of a muscular expansion of the body, called a foot. They belong to the order of *Scutibranchiata* (*scutum*, a shield, *branchie*, gills), the gills, or lung, being protected by a shield of shelly or calcareous matter. The shells of *Haliotis*, however, resemble, in general outline, the form of the human ear; several of the species, of which as many as eighty are known, are rough externally though brilliant within.

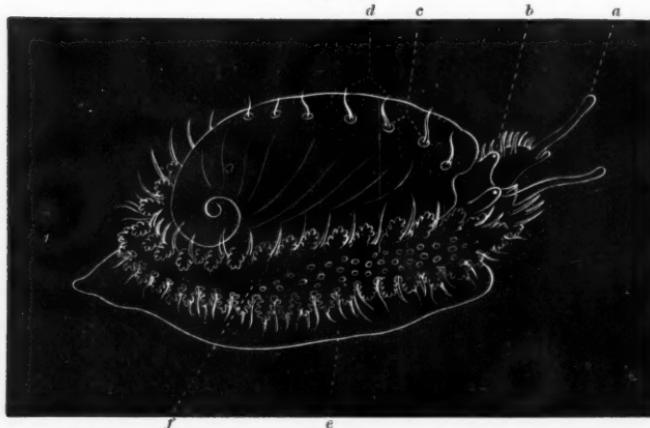
The shell of *Haliotis* (Fig. 43) may be compared to a flattened *Turbo*, or top-shell, with small apex whorls and a disproportionately large body or basal whorl, depressed, largely open, and having but a slightly elevated spire, composed of but few whorls. Again, as regards form, it holds the same position in comparison with *Turbo* that *Concholepas* does to *Purpura*, *Sigaretus* to *Natia*, and to follow the analogies into the *Geophila*, *Vitrina* to the more closely whorled trochiform land species.

Fig. 43.



The animal (Fig. 44; *a*, tentacle; *b*, eyes; *c*, holes in the shell for the passage of the tentacles, *d* and *f*; *e*, foot) adheres to the rock like the *Patellas* and *Fissurellas*. To the latter genus it is somewhat allied through its anatomy; the arrangement of the teeth upon the lingual ribbon is said to be like that of *Trochus*. Cuvier found that every individual he examined had an ovary, and therefore concluded

Fig. 44.



that the *Haliotides* were hermaphrodites.* Swainson considered them as occupying a position among the phytophagous, or vegetable eating gasteropods, analogous to the *Volutidae* among the *Zoophaga*, or carnivorous mollusks; the analogy being particularly apparent by a comparison of *Haliotis* with the *Melo* group of the *Volutidae*.

The chief peculiarity of these animals is, that their shells are perforated with a regular series of holes for the passage

* In July, 1867, specimens of the shells of *Haliotis*, from Monterey, were received by me, which combined the peculiarities of the two very distinct species, *H. rufescens* and *H. Cracherodii*, to a remarkable degree. These abnormal forms are of exceedingly rare occurrence, and in the great number of specimens that I have examined, I have been unable to obtain additional illustrations. The specimens referred to impressed me as being hybrids, and I feel confident that further investigation will corroborate my opinion that species of *Haliotis* will occasionally cross. (Proceedings of the California Academy of Sciences, Vol. iii, p. 361.)

of the sea-water to the respiratory organs, analogous to the single vertical and nearly central hole in the shell of *Fissurella*. The holes in *Haliotis* are placed in a row nearly equidistant from centre to centre, upon the left side of the shell, parallel with the columellar lip, and being required only in that part of the shell which covers the branchial cavity, those nearest the apex are closed or grow up as the animal advances in growth. The holes furnish a passage for slender tentacular filaments which the animal can protrude at pleasure; the hole or notch for the passage of the anal siphon is situated at the posterior margin of the shell. The animal of *Haliotis*, according to P. P. Carpenter, "has two gills and two auricles, instead of one, as in the top-shells." Its head is blunt and terminates in a short muzzle, with two subulate tentacles and two stout eye peduncles at their bases. Upon the upper extremity of the foot it has a rudimentary opercular lobe, but no operculum. The foot is very large, rounded at the ends and fringed with thread-like tentaculæ, which, when the animal is protruded from the shell, below the surface of the water, are gently swayed with a somewhat vibratory motion. "The muscular attachment, instead of being horseshoe shaped as in ordinary univalves, is round and central, as in the oyster." (Carpenter.)

In adult shells in many of the species, the roughened portion of the interior indicates the area of the muscular attachment, while in young specimens the impression of the muscle is not shown.

The *Haliotides* are sedentary in their habits, as one would suppose, being both vegetarians and conservatives, and though capable of locomotion, they move but little and quite slowly; their structure, as seen in the powerful muscular foot, shows it is made for adhesion. They attach themselves to the rocks with the greatest tenacity, and I have often found it exceedingly difficult to remove them, though using a stout trowel, of a shape similar to the kind used by bricklayers.

The animal of *Haliotis* is exceedingly tenacious of life. I have frequently removed it from the shell by means of a sharp knife, and by throwing it, minus the shell, back into the water, it would at once descend and place itself in its normal position upon a rock, to which it would adhere with apparently as much tenacity as before it was deprived of its shelly covering.

"The brilliant and highly colored interior of these shells producing sometimes an iridescent effect, has been attributed by Sir David Brewster, Dr. Carpenter, and others, to minute striæ, or grooves, on the surface of the nacre, which alternate with others of animal membrane. The color is produced by the nature of the laminae, which decompose the light in consequence of the interference caused by the reflection from two sides of each film, as may be seen in soap-bubbles. The nacreous laminae, when magnified, indicate a minute cellular structure. The cells are of a long oval form, and their short diameter is not above $\frac{1}{500}$ of an inch." (Jeffreys.) The animal of *Haliotis* is mentioned by Athenæus as being exceedingly nutritious but indigestible. "The maritime negroes of Senegal esteemed one species a great delicacy. . . . *H. tuberculata* is habitually eaten by the poor in the north of France and our Channel Isles, where it is occasionally cooked and served at the tables of the rich. It requires a good deal of beating and stewing to make it tender." (Jeffreys.)

In New Zealand the animal of *H. iris* is eaten by the natives, and is called "Mutton-fish." Another species is eaten in Japan. In California the animals of the two most abundant species, *H. rufescens* and *H. Cracherodii*, are frequently eaten by the Americans residing along the coast, and are a common article of food with the Chinese, who collect them in large quantities at Monterey, and other favorable localities north and south of that place, remove the animals from the shells, and dry the former for future use or for export to their native country.

The shells are also shipped from San Francisco to China and Europe in considerable quantities. In the former country they are used for inlaying in connection with the lacquer-work for which the Chinese are so famous, while in Europe they are used in the arts, and many are polished and treated with acid, to be returned to the United States and sold for card receivers or ornamental objects.

Their beauty has not escaped the eye of the savage, as pieces of the shells are worked into a variety of forms and worn to ornament the person, by the Indians of north-west America. They are also esteemed by the Indians living in the interior of the continent. My friend, Dr. Edward Palmer, recently informed me that when he was in the Indian Territory he saw a horse purchased with an *Abalone* shell. They are still held in esteem, but are not so highly prized as formerly.

Jeffreys says that in some parts of Guernsey the *ormer* was used for the purpose of frightening the small birds from the standing corn; three or four shells are strung loosely together and suspended from the top of a pole, so as to make a clatter when moved by the wind. Formerly they were used there to ornament the plastered exteriors of cottages, the plaster being studded with them.

In some places in California I have seen the shells of *Haliotis rufescens* suspended beside a sink, or placed upon a toilet-stand for holding the soap. They are quite convenient to the collector for holding or carrying smaller specimens in while searching along the shore, a purpose for which I have frequently used them. Sometimes the naturalist is well repaid by the examination of the back of large specimens of the roughly sculptured species; for, besides the miniature forest of marine vegetation, corallines, algae, etc., which furnish an abiding place for diatoms and other minute forms, in the crevices of the shell can be found numerous small species of mollusca that would otherwise be seldom obtained.

The value of the exports of the *Haliotis* or Abalone shells from San Francisco was, in the year 1866, \$14,440, being 1697 sacks, each of two bushels capacity; and in the year 1867 the export had increased to 3713 sacks, worth \$36,090.

Jeffreys, in remarking upon the sale of the European species, *H. tuberculata*, says that the importation into England of the *Meleagrinæ*, or true mother-of-pearl shells, from the South Seas, has interfered with the sale of the "ormer" at Guernsey, although he was informed that one merchant . . . purchased from four to nine tons annually, paying seven shillings and sixpence per hundred weight, equal to about thirty-seven and one-half dollars per ton, American gold.

The geographical distribution of the *Haliotides* is widely extended; it is remarkable however that not a single species is found upon either coast of South America, or upon the east coast of North America, while no less than five or six species* are found on the west coast of North America, between the Gulf of California, northerly to, and including a part of Alaska.

Species are also found in Japan, China, Australia, New Zealand, Tasmania, and many of the smaller islands of the Indo-Pacific waters; the Canary Islands, Africa at the Cape of Good Hope, and the Atlantic Coast of Europe.

The length of this paper prevents my treating at this time of the uses made of the *Haliotis* shells in the arts by civilized peoples, or the purposes to which they are applied by the ruder races of mankind.

*Of these five or six species, *H. splendens* Reeve, is found at San Diego and the islands off the coast; *H. corrugata* Gray, Santa Barbara to San Diego and Catalina Island; *H. rufescens* Swainson, from Mendocino County, southerly, to San Nicholas Island; *H. Kamschatkana* Jonas, from Monterey, northerly to Alaska, also in Japan; *H. Cracherodii* Leach, from the Farallone Islands off the entrance to San Francisco Bay, southerly to San Diego; and *H. Californiensis* Swainson, a doubtful species, upon the islands (and the outer coast?) of Lower California. This latter form, which is regarded by many as a variety of *H. Cracherodii*, is quite rare, though I have several specimens in my collection. *H. Cracherodii* has from five to eight holes, while the other has from eight to thirteen.

A CHAPTER ON CUTTLE-FISHES.*

BY LUCIE L. HARTT.

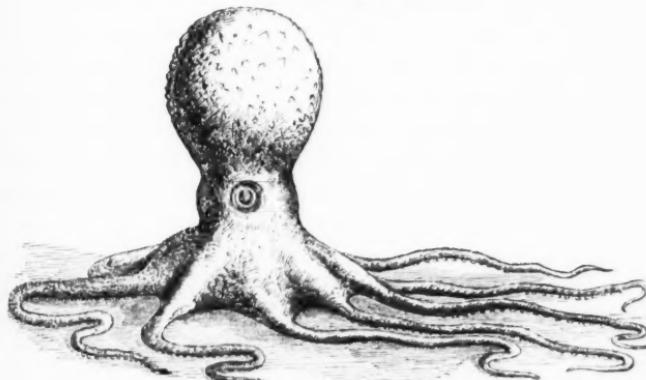


Fig. 45.

It was during my first visit to Brazil, that one day, while busily engaged in examining a reef at a little town on the coast called Guarapary, my eye fell on an object in a shallow tide-pool, packed away in the crevice of the reef, which excited my curiosity. I could see nothing but a pair of very bright eyes ; but, concluding that the eyes had an owner, I determined very rashly to secure him. I had been handling corals and seemed to have forgotten that all the inhabitants of the sea are not harmless. I put my hand down very quietly so as not to ruffle the water, when, suddenly, to my surprise, it was seized with a pressure far too ardent to be agreeable, and I was held fast. I tugged hard to get away, but this uncivil individual, whoever he was, evidently had as strong a hold on the rocks as he had on my hand, and was not easily to be persuaded to let go of either. At last, however, he became convinced that he must choose between

*The facts herein narrated were drawn from one of my note-books, and were an actual experience of mine. The story is told in the first person for obvious reasons.—C. F. HARTT.

us, and so let go his hold upon the rocks, and I found clinging to my right hand, by his long arms, a large octopod cuttle-fish, resembling the one figured at the head of this article, and I began to suspect that I had caught a Tartar. His long arms were wound around my hand, and these arms, by the way, were covered with rows of suckers, somewhat like those with which boys lift stones, and escape from them was almost impossible. I knew that this fellow's sucking propensities were not his worst ones, for these cuttle-fishes are furnished with sharp jaws, and they know how to use them too, so I attempted to get rid of him. But the rascal, disengaging one slimy arm, wound it about my left hand also, and I was a helpless prisoner. In vain I struggled to free myself,—he only clasped me the tighter. In vain I shouted to my companion,—he had wandered out of hearing. I was momentarily expecting to be bitten, when the "*bicho*" suddenly changed his mind. I was never able to discover whether he was smitten with remorse and retired with amiable intentions, or whether he only yielded to the force of circumstances. At any rate he suddenly relinquished his hold upon my hands and dropped to the sand. Then raising himself on his long limsy arms, he stalked away towards the water, making such a comical figure, that in spite of my fright I indulged in a hearty laugh. He looked like a huge and a very tipsy spider, staggering away on his exceedingly long legs.

The cuttle-fish belongs to the Mollusks, a branch of the animal kingdom distinguished for its members being built on the plan of a sac, and to which Mr. Hyatt has applied the more appropriate name of *Saccata*. The cuttle-fishes are distinguished from all the other Mollusks, such as snails, clams, etc., by having a large head, a pair of large eyes, and a mouth furnished with a pair of jaws, around which are arranged in a circle, eight or ten arms furnished with suckers.

In the common cuttle-fish or squid of our coast, the body, which is long and narrow, is wrapped in a muscular cloak

or mantle, like a bag fitting tightly to the back but loose in front. It is closed up to the neck, where it is open like a loosely fitting overcoat, buttoned up to the throat. Attached to its throat, by the middle, is a short tube open at both ends. This tube, or siphon as it is called, is fastened to its throat, and can be moved about in any direction.

The animal breathes by means of gills, which are attached to the front of the body inside the cloak and look like the ruffles of a shirt bosom. By means of these gills the air contained in the water is breathed, and they answer the same purpose for the cuttle-fish that our lungs do for us.

In order to swim, the animal swells out the cloak in front so that the water flows in between it and the body. Then it closes the cloak tightly about the neck so that the only way the water can get out is through the siphon. Then it contracts very forcibly its coat, which, it must be remembered, is a part of the animal, and the water is driven out in a jet from the siphon under the throat, and the body is propelled in the opposite direction; that is, backward like a rocket through the water. This siphon is flexible like a water-hose, and can be bent so as to direct the stream not only forward, but sidewise and backward, so that the animal can move in almost any direction, or turn somersets with perfect ease, and so rapidly do some cuttle-fishes swim that they are able to make long leaps out of the water. Usually, however, the animal swims backward, with its long arms trailing behind. Our common cuttle-fish of this coast has, in addition to its eight arms, two long slender tentacles which may be withdrawn into the body. The tail is pointed, and furnished with a fin on each side.

The Octopods, to which the Brazilian cuttle-fish (Fig. 45) belongs, have round purse-like bodies, and eight arms united at the base with a web, and they swim by opening and shutting their arms like an umbrella; in this mode of swimming they resemble the jelly-fishes.

The paper Nautilus is nothing in the world but a female

cuttle-fish that builds a shell. There was a very pretty story told of her habits, by Aristotle, the old Greek naturalist, which every one believed until quite lately. He said that she rode on the top of the waves, seated in her boat-like shell, and spreading her broad arms to the winds for sails. But unfortunately the story has no foundation in fact. She either crawls about on the bottom of the sea, or swims quite like any other cuttle-fish, shell foremost, only occasionally coming to the surface. Strangely enough she holds the two broad hand-like extremities of the arms against her body, and it is the inside of these arms that secrete the paper-like shell, which is only a sort of cradle for her eggs. Not so with the pearly Nautilus, which is furnished with a beautiful, coiled up, pearly shell, formed on the outside of the animal. This shell is divided into numerous chambers, and the animal living in the outer one builds a partition across the back part of it as the shell grows.

Cuttle-fishes are sometimes used for food by the Brazilians, and different species may be seen in the markets, where one frequently finds them still alive. Sometimes, as he stoops to examine one, its body is suddenly suffused with a deep pinkish glow. Before he has time to recover from his surprise this color fades, and a beautiful blue takes its place as rapidly as a blush sometimes suffuses a delicate cheek. The blue, perhaps, is succeeded by a green, and then the whole body becomes pink again. One can hardly conceive anything more beautiful than this rapid play of colors, which is produced by the successive distention of sets of little sacks containing fluids of different colors, which are situated under the skin.

The cuttle-fish is also furnished with a bag containing an inky fluid, which, when the animal is attacked or pursued, it ejects into the water, thus completely blinding its adversary and effectually covering its retreat. It is from this fluid that the color *sepia* is made. Beside carrying an ink-bottle, some species of cuttle-fish are provided with a long,

delicate, horny pen, which forms a sort of stiffener to the back. In some species the pen is hard, thick and broad, and the cuttle-fish bone of commerce is a pen of this kind. The species found in our waters is very small, and not at all dangerous, being barely large enough to draw blood from the hand; but in the tropical seas they are very large, powerful and dangerous.

The cuttle-fish is the original of Victor Hugo's devil-fish, so vividly described in the "Toilers of the Sea." If the devil-fish were a beneficent creation, I should be sorry to destroy your faith in it; but as it is, I believe it will be rather a relief than otherwise to know that in some important respects, Victor Hugo's story of it is a fable. The Kraken was a mythical cuttle-fish of fabulous size.

SOMETHING ABOUT CRABS.

BY REV. SAMUEL LOCKWOOD.

WELL do we remember our boyish sport catching crabs. A stout string, a piece of fresh offal, a hand-net, and another boy with us and a good place on an anchored raft,—then for fun. The meat was dropped to the bottom; the cancerous varmint took hold, and kept hold; then we slowly drew the bait up, and, when within a few inches of the surface, chum adroitly slipped the scoop-net under. But wouldn't "spider-legs" run up the sides of the net! It needed all our alertness to secure the prey. What a luxury those crab dinners! But what was that pleasure compared to the delight of our riper years, when we made the acquaintance of the inner life of these entertaining people, *Lupa*, *Libinia*, *Pagurus*, and others. We have spent many health-giving days with them at the "watering-places," and many hours in the drawing-

room, they affording us abundant refined entertainment in return for our aquarian hospitality.

A wonderful thing, so considered, is told in the court journals of the Empress Eugenie on public days; how that she appears in sumptuous array, and then will disappear, and in an incredibly short space of time reappear in an entire and elaborate change of dress. Her admirers gaze as if it were magical. But suspended from the ceiling of the boudoir, garment within garment is the awaiting suit. The Empress has but to doff, and then to don, while many zealous and tasteful fingers are busy all around—a little readjustment of her coiffure, and presto! all is done! and the changed creature is again among her astonished admirers. But suppose an old knight could put off as one unbroken suit his iron encasement, with not so much as the unlacing of his gear, and then on the nonce should appear in a new suit of mail of high finish and faultless fit,—would not this man in iron beat my dame in silk? And yet the knightly and the queenly feat are nowhere when we instance the exuviation and redressing of *Mrs. Lupa dicantha*, the common edible crab. During the first year of its life, this crab puts off its hard shelly encasing several times. That is to say, when a youngster, it requires several new suits. After the first year until it gains the fully matured age, an annual suit suffices. When fully grown, its case is permanent. We knew some years ago an old crabber, wholly illiterate, but whose intelligence was above the average. He had "crabbed" for the market many years. Often when supplying our family with fish, has he been closely questioned by us about the crabs, and always have his statements tallied one with another. In our notes occur the following in the fisherman's own words:—"I hev ketched soft crabs for market many a year. The crab sheds every year, chiefly in early summer. At that time the he one is mighty kind to his mate. When she shows signs of shedding, the he one comes along and gits on the she one's back, quite tenderly-like, and entirely

protects her from all enemies, whether of fishes, or of their own kind. She is now getting ready to shed, and is called a *shedder*.^{*} Soon the back begins to burst nigh to the tail. She is then called a *buster*. The he one is then very anxious to find a good place for her, either by digging a hole in the sand or mud, or else looking up a good cover under some sea-weed. Here he brings her, all the time hovering nigh, and doing battle for her if anything comes along. She now—and it only takes a few minutes—withdraws from the old shell. And she comes out perfect, every part, even to the inside of the hairs, eyes and long feelers, almost like the whiskers of a cat. At the first tide she is *fat*, and the shell is soft, just like a thin skin. She is then called a *soft shell*, and it's the first-tiders that bring the high price. At the second tide she is perfectly watery and transparent, and is called a *buckler*; but she is not worth much then. At the third tide she is again a *hard shell*, just as she always was, only bigger."

"Have you seen all this with your own eyes?" we asked.

"Lor, sir, yes, hundreds and hundreds of times."

For the sake of contrast with these observations of an illiterate man, let us give the gist of an entertaining passage from Gosse:

"Peering into a hole I saw a fine large crab. Though he made vigorous efforts to hold fast to the angles of his cave, I pulled him out, and carried him home. I noticed that there came out with him the claw of a crab of a similar size, but quite soft, which I supposed might have been carried in there by my gentleman to eat, or accidentally washed in. After I had got him out—it was a male—I looked in and saw another at the bottom of the hole. Arrived at home I discovered that I had left my pocket-knife at the mouth of the crab-hole. I returned, the crab had not moved. I drew it out, as I had done the others. But lo! it was a soft crab, the shell being of the consistence of wet parchment. It was a female, too, without any sign of spawn, and had lost one

claw. I carefully put the helpless creature into the hole again.

"What then are we to infer from this association? Do the common crabs live in pairs? And does one keep guard at the mouth of the cavern while its consort is undergoing its change of skin? If this is the case it is a pretty trait of cancerine sagacity, and one not unworthy of their acute instinct and sagacity in other respects. I have no doubt that the claw of its mate was unintentionally torn off in its efforts to grasp some hold when resisting my tugs in dragging him out."

See, then, the beautiful parallel—the simple remark of the illiterate observer, and the learned queries of the practised naturalist.

Not a little interest have we felt in an individual known to us as the "Sea Spider," or "Spider Crab." Wishing to make a good introduction for our friend, and as some who have no desire to know Mrs. John Smith might perhaps feel flattered if presented to the lady of Johannes Smythius, Esq., so we would say, that by Spider Crab, we mean no less a personage than *Libinia canaliculata*. She is regarded by some as a pest on the oyster beds, and is accused of eating the oyster spat or young. How much truth there may be in this is to us unknown. At any rate we have never seen the slightest evidence to sustain the charge. We have regarded her appetencies as omnivorous. But, as our acquaintance has been chiefly in the drawing-room, it may be that there her tastes became fastidious. One peculiarity of habit is all that we have time to describe. The Spider Crab will grow as large as one's hand. A pet that we had a long time was only an inch wide across the shell. We must tell the truth, and say that her aspect was not the most tidy or even cleanly. Her back looked much as if she had taken a glue bath, and then, like a chicken, a dust bath afterwards. Through this agglutinous coat sundry small sharp spines appear. She does not covet society, and so withdraws to

a cozy grotto, whose walls are green with the tender little fronds of the young sea-lettuce, the *Ulva latissima*, and the delicately crimped ribbon leaves of the *Enteromorpha intestinalis*. It did not please us much to see the pert Libinia, with her nippers like little shears, snipping off the velvet lining of the cave. Being indulgent we did not interfere, but left her to her own enjoyment. When we returned, out came Mrs. Libinia in full dress to greet us. On every spine of her uncouth carapace was a green ribbon,—all gracefully waving as she strutted in the open grounds of the establishment. What a sight to look at! And what a lesson in animal psychology! What was the mental process? Was it a device,—"a moving grove," like Macduff's, in order to deceive its prey? If so, what intelligence! Or, was it her vanity? Done just for the looks of the thing! If so, what inexplicable caprice! This fact we have seen; and an intelligent aquarist friend assures us he has seen it a number of times. The English naturalists tell the same of their Sea Spider (*Maia squinado*). And one of them (Harper) even makes us almost believe that when this humor is upon it, it will even dance, or at least exercise a certain rhythmic movement at the sound of music. Query; has it that hardihood when it hears the refrain:

"They hang both men and women there
For the wearing o' the green!"

If so, Madame Maia, may your gayety never be your ruin.

We can only introduce one more of these curious little creatures, and that must be the little Hermit Crab, the *Pa-gurus longicarpus*, so common on our shores. Though a recluse, for he lives in a vacated sea-shell all alone, yet of hermit gravity he has none. In fact he is constitutionally a funny fellow. This crab has his two hands, or claws, greatly larger than the others; and of these, the right one is much stouter than the left. The next three pairs of claws behind are tipped with simple hooks, which having a considerable leverage power, are really efficient grapnels with

which to pull himself along when he travels, carrying his house on his back; while the claws of the fifth or last pair are very diminutive, and yet have a beautiful structural relation, as they enable the animal to perform the small amount of movement needed by the body inside the shell. Behind all these limbs the body is entirely naked, hence the necessity of an empty sea-shell with which to cover it. On the extreme end of the naked body is an apparatus for taking firm hold of the little column in the upper part of the shell.

There is a queer monkey-like drollery in the looks of the Little Hermit. We had in our aquarium one of rather large size, and which occupied a shell of the required capacity. Of this specimen we were very proud. The shell on its upper part was ashen white, with a fine colony of *Hydractinia*, like tiny sea-daisies. And mystic beings they were; for by that strange law of parthenogenesis, they were the great-grandparents of those huge and splendid creatures, the gorgeous Acalephs! We had also a little Hermit in a small *Nassa obsoleta*. And what about this young scapegrace, whom we soon almost wished obsolete? On he came, and climbed right up into this pretty parterre, and having secured himself with his grapsnels on top of his neighbor's house, most deliberately, now with the right claw, and now with the left, he pulled off my weesome pets, stowing them into his ugly mug with a movement so regular, that it seemed almost rythmical, and yet so cruelly comical, that it made me most laughably mad.

But the Hermit grows, while the sea-shell which he occupies does not. Hence like many bipeds, he has his "first of May." So he goes house-hunting. This must be understood literally. He finds a shell. Will it do? First then is it really "to let." He will "inquire within." This he does, if not the most courteously, very feelingly. Satisfied on this point, the next question is, will the house suit. He turns it over, then turns it around. You see the weight of

one's house is quite an item in the reckoning to him who has to carry it on his back. One inspection more. How is it inside? Is it entirely empty, and is it of the right size? Up goes one of the long slender limbs of the second pair, and the interior is thoroughly explored. All right! Just the house he is after. His mind is now made up to move. Look at him! Quick! or you'll miss it! Out comes the body from the old house, and pop it goes into the new one! The resolution to move was taken, the surrender of the old house was made, and the occupancy of the new was effected, and all within a fraction of a second of time.

Sometimes this matter goes on less pleasantly. Two house-hunters may find the same tenement. Should both desire it then comes the tug of war. Live together they neither can, nor will. The affair is settled by a battle, in which the stronger usually proves his claim right by the Carlyleian logic and morals, viz., might. Quite often from these encounters a terrible mutilation results.

To us it is a sad sight to see the Little Hermit, when "his time has come," and he knows it; that is when *Pagurus* must die. However droll his career may have been, the Little Hermit is grave then. And what a strange fact it is! Who can explain it? The poor little fellow comes out of his house to die! Yes, in order to die. To us humans home is the only right place to die in. But for *Pagurus* home has no attraction at this solemn time. Is it because he feels encoffined that he comes out, that "his feet may be in a wide place?" Poor fellow, with a sad look and melancholy movement, he of his own will quits the house for which he fought so well. Those antennae, or feelers, that often stood out so provokingly, and were so often poked into everybody's business, now in a feeling manner lie prone and harmless. The eyes have lost their pertness. There lies the houseless Hermit on that mossy rock, stone dead!

The human side of these lowly creatures, as unfolded by close observation of their habits, is much better understood

in England than with us. Our naturalists seem to be chiefly occupied with the study of structure. When their habits are better understood we shall doubtless learn something which as yet are only known of foreign species. One of these we would instance in closing.

The Hermit, as its name imparts, loves solitude so far as the occupancy of its shell is concerned. There is an English species, *Prideaux' Hermit*, that seems to take Patrick's view of seclusion: "It's very nice to be all alone by one's self, especially if one has his sweetheart with him." So this Hermit believes in having for a companion the dressy Cloaklet *Aetinia*; nor will he live without her. And if form and color be considered, remarkably recherche is this Sea-anemone. Her form adapts her to surround the shell mouth like a frill, while her disk is of waxy white, and the rest is elegantly varied with reddish-brown, rose-purple and scarlet. This gorgeous creature adheres around the entrance of the Hermit's shell, so that his lookout is from a mantel richer than any field of cloth-of-gold. But when the Hermit has outgrown his house, and moving-day comes, does he leave his beautiful though helpless companion? No, a better gallantry is his. He causes her to loose her long adherence to the shell's mouth, and to cleave to the underside of his thorax. In this way he carries her with him to their new home. And what then? Most tenderly he places her in position, and holds her there until a good adhesion of the base takes effect, when she with her protector, is snugly domiciled again. These facts are given in pleasant detail by Gosse, from whom we quote the following:

"Is there not here much more than what our modern physiologists are prone to call automatic movements, the results of reflex sensorial action? The more I study the lower animals, the more firmly am I persuaded of the existence in them of psychical faculties, such as consciousness, intelligence, will and choice! and *that*, even in those forms in which as yet no nervous centers have been detected."

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MORSE ON SHELL DREDGING.

Thus ends our history of these cancerine crustacea, as the naturalists call them, namely, the crabs. Our hope has been that the reader does not regard it as crusty, cancer-ous, or crabbed.

SHELL DREDGING.

BY EDWARD S. MORSE.



A STRONG arm and an immunity from sea-sickness are among the important requisites of a good dredger. To one who has pulled up a well-filled dredge from fifteen or twenty fathoms, the necessity of a strong arm is obvious, especially if this act has been attended with the not unusual accompaniments of a rough sea, and a cold breeze which stiffens the fingers while grasping the wet rope. One can only pity those who are sea-sick, for they are helpless.

In dredging one oftentimes enjoys the keenest pleasure, attended with the greatest bodily discomforts. The miseries we will not mention. The delights come when the contents of the dredge are sifted, and there lies before you the only treasures of the deep; treasures that can be obtained in no other way. It is true that many deep-water species of shells are obtained from the stomachs of the haddock, cod and other fishes, particularly from the haddock, which seems to live principally on mollusks. Specimens procured from this source are generally impaired by the action of the juices of the stomach. The beauty of dredging consists in getting the objects in their living condition; and then you may keep them alive in sea-water for some time, and see them crawl about and watch their singular ways.

A dredge should not be too large, perhaps sixteen inches across the mouth. The frame is made of a flat bar of iron, an inch in width and an eighth of an inch in thickness, one edge of which should be hammered sharp and turned out, to

form the scraping edge, as represented in the cut at the close of this article. The other edge must be drilled with small holes an inch apart, to which a stout cloth bag is to be sewed. It is well to have the sides of the bag made of netting so that the water may drain from it quickly. The iron shanks are to be fastened to the dredge, as shown in the figure. A dredge of this shape, however it falls, when drawn slowly along, is sure to scrape up the mud. It is well to have for a rope a good strong one of manila-hemp, and this should be well secured to the dredge. It is necessary to have the length of the rope more than twice the depth you intend to dredge in; thus, if you were to dredge in ten fathoms, you should be provided with at least twenty-five fathoms of rope, as it is necessary to give the dredge sufficient "slack" in order that it may drag properly. Should the dredge meet with any obstacle, it can generally be liberated by retracing the track passed over, dragging the dredge in an opposite direction. It is well to add that a row-boat is best to dredge from, that is for light dredges, as you want to move very slowly through the water. A fine sieve is necessary to sift out the mud, a few pails in which to empty the contents of the dredge, and some large-mouthed vials in which to save the animals alive.

After a little experience in dredging you will notice that certain species live on certain "bottoms." Thus, if your dredge comes up filled with mud, you must sift the mud carefully, and from it you will find certain forms different from those you may dredge from a sandy bottom. It is well to examine your sieve often, that the smaller species may not be washed away. Sometimes the dredge will come up filled with stones; do not throw these away in disgust, but examine each stone carefully, and clinging to them you will find several species of shells found in no other way. One species, called *Cemoria Noachina* (Pl. 4, figs. 2, 3), is like a very small limpet, with a little hole in its top from which radiate little ribs, giving the shell a very elegant appearance

under the magnifier. Then there are certain species of shells (Chiton, Pl. 4, fig. 1) which cling to the stones, limpet-like, but instead of having a shell of one piece covering their back, the shell is composed of eight transverse pieces, one lapping over the other. When detached from the rock they often roll up like a pill-bug. On the eastern coast of Maine there is one large species which can be taken from the rocks at low-water mark. The species dredged in Massachusetts Bay are generally small; one or two of them are brightly colored with shades of red.

Two other species called *Velutina* (Pl. 4, figs. 4, 5) are often found adhering to the rocks brought up in this manner. By far the most beautiful and interesting animals are contained in the little cells which often cover the rocks from deep water. They are arranged in little patches like mats, some species making a perfectly circular figure, others covering the rocks in irregular patches. These belong to the lowest group of mollusks, and are called Polyzoa. Under the microscope the mass is seen composed of little cells, arranged like the stones in a pavement. Each one of these cells has a little opening protected by a small lid, which opens to allow the animal within to protrude a tuft of minute feelers. It would require too long a time to show the affinity of these animals to the clam and oyster, yet they are among the lowest forms of this group. There are many species on our coast, some of which have been described as new, others are similar to British species.

We figure on Plate 4 several species of shells one is likely to dredge on our New England coast, though representing but a small portion of the species that may be found, and we may mention here, with propriety, that the State of Massachusetts—with that liberality that has always characterized the acts of its legislature—has now in preparation a new edition of "Gould's Report on the Invertebrate animals of the State." This book, when published, will contain carefully engraved figures of all the species of shells found

within its limits, and the marine species alone (containing all the animals that belong to the branch of mollusca, though many have no hard calcareous shells) number three hundred and sixteen. Several of these are cuttle-fishes, and there are many mollusks which have no shells, the branchiae or gills being naked; hence they are called Nudibranchia. They comprise the most beautiful animals in the branch of Mollusca, for certain species are very brilliantly colored.

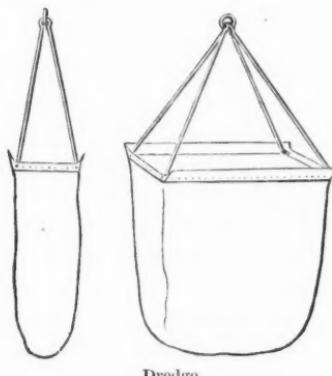
The species figured on the plate are among the few that the collector is likely to bring up while dredging in our bays and inlets, in depths of from ten to fifteen fathoms. Should he be ambitious to throw his dredge into depths of fifty or one hundred fathoms, many other species will be secured that he could not get in water of less depth.

The outlines given will be found sufficiently accurate to enable the collector to identify the species represented. Fig. 1 represents *Chiton albus*; the shell is not quite half an inch in length; it is generally a dead white color. Figs. 4 and 5 represent *Velutina haliotoides* and *V. zonata*, the latter differing from the former in having a more solid shell, and in having the shell marked with bands of brown. Fig. 6 is the *Natica immaculata*, a pure white shell of the size represented; very common. Fig. 13 represents another species, *Natica clausa*; color from a white to a dark reddish brown. The little lid that closes the aperture of most marine shells is in this species white and shelly, and not of the horny consistency characterizing the opercula of most shells in our region. *Pandora trilineata* (Fig. 24) is easily distinguished by its white pearly color, and the manner in which the valves are pressed together. *Lyonsia hyalina* (Fig. 20) has a very fragile translucent shell covered with radiating wrinkles. *Thyasira Gouldii* (Fig. 18) has a delicate white shell, along one margin of which is a deep fold. The shell of *Astarte castanea* (Fig. 22) is quite solid, and chestnut-colored. It is found abundantly in Provincetown harbor at low water. *Astarte sulcata* (Fig. 25) is known by its strongly marked

concentric ridges. The color in young specimens is very light-brown; in old ones the shell is of a brownish olive color. *Cardita borealis* (Fig. 28) has a brownish shell with the ribs crenulated. *Cardium pinnulatum* (Fig. 33) has a dingy white shell, ornamented with about twenty-five ribs, each of which has a series of little scales. *Yoldia limatula* (Fig. 30) has a beautifully polished shell, of a light green color. The hinge is complicated by a number of long sharp teeth, so closely interlocked, that it is difficult to separate the valves without breaking them. *Tellina tenera* (Fig. 31) has a white iridescent shell. *Nucula tenuis* (Fig. 27) is smooth and green in color. *Nucula delphinodonta* (Fig. 29) is brownish green. All the Nuculas have the same peculiar hinge of numerous interlocking teeth. *Crenella glandula* (Fig. 26) has a brownish yellow shell, marked with minute radiating lines. *Terebratulina septentrionalis* (Fig. 32), though apparently related to the other bivalves, is widely different from them and belongs to another order; the shell is secured to the bottom, generally on stones, by a fleshy peduncle which passes through a hole in the upper valve. *Dentalium striolatum* (Fig. 9) has a shell like a long curved tapering tube. *Scalaria Grænlandica* (Fig. 12) has a shell that looks more like a tropical species than a denizen of our cold northern waters. The shell is very attractive, with its turreted spire banded by prominent ribs. It is related to the foreign species, commonly called the "Wentle trap," which formerly brought fabulous prices among shell collectors. *Margarita undulata* (Fig. 16) is one of our most beautiful marine shells. The color of the shell when fresh is rose-red with a pearly lustre. Another species of this genus, *Margarita cinerea* (Fig. 17), is ashy white. There are several species on the coast, and all are so characteristic that they can be easily identified. *Cylichna alba* (Fig. 23) is bluish white. *Turritella erosa* (Fig. 11) has a pale brown shell, and *Olostomia producta* (Fig. 10) has a light brown-colored shell. *Bela harpularia* (Fig. 7) is brownish in color,

and *Bela turricula* (Fig. 8) is thin and pure white. *Tritonium pygmæum* (Fig. 14) is yellowish white. *Admete viridula* (Fig. 15) is white. *Trichotropis borealis* (Fig. 21) is yellowish in color. *Aporrhais occidentalis* (Fig. 19) is one of the most singular shells that we have. It is rare on our coast, but is common towards Newfoundland.

We must bear in mind that the species mentioned are a few among the many that most likely will be collected in dredging on our coast.



Dredge.

EXPLANATION OF PLATE IV.

Fig. 1. *Chiton albus* Linn.
 Figs. 2, 3. *Cemoria noachina* Linn.*
 Fig. 4. *Velutina haliozooides* Müll.
 Fig. 5. *Velutina zonata* Gould.
 Fig. 6. *Natica immaculata* Totten.
 Fig. 7. *Bela harpularia* Couthouy.
 Fig. 8. *Bela turricula* Mont.
 Fig. 9. *Dentalium striolatum* Stimpson.
 Fig. 10. *Odostomia producta* Adams.*
 Fig. 11. *Turritella erosa* Couth.
 Fig. 12. *Scataria Greenlandica* Perry.
 Fig. 13. *Natica clausa* Sowerby.
 Fig. 14. *Tritonium pygmæum* Gould.
 Fig. 15. *Admete viridula* Fabr.
 Fig. 16. *Margarita undulata* Sby.
 Fig. 17. *Margarita cinerea* Couth.
 Fig. 18. *Cryptodon Gouldii* Phil.*
 Fig. 19. *Aporrhais occidentalis* Beck.
 Fig. 20. *Lyonsia hyalina* Conrad.
 Fig. 21. *Trichotropis borealis* Sby.
 Fig. 22. *Astarte castanea* Say.
 Fig. 23. *Cyllichna alba* Brown.
 Fig. 24. *Pandora trilineata* Say.
 Fig. 25. *Astarte sulcata* Mont.
 Fig. 26. *Crenella glandula* Tott.
 Fig. 27. *Nucula tenuis* Mont.
 Fig. 28. *Cardita borealis* Conrad.
 Fig. 29. *Nucula delphinodonta* Mighels.
 Fig. 30. *Yoldia limatula* Say.*
 Fig. 31. *Tellina tenera* Say.*
 Fig. 32. *Terebratula septentrionalis* Couth.
 Fig. 33. *Cardium pinnulatum* Conrad.

* Enlarged twice.

REVIEWS.

REVIEW OF SCANDINAVIAN NATURAL HISTORY LITERATURE IN 1867-8.

By Dr. C. F. Lütken.—As an appendix to my former report I beg leave to insert a review of some Norwegian papers recently received, viz., the University programme of the University of Christiania, for 1868, by Prof. Sars, and the volume, for 1867, of the Proceedings of the Society of Science of the Norwegian Metropolis, the first named of which is of unusual scientific importance and interest.

Among the many valuable works with which Prof. Sars has enriched science, his last, "*Mémoires pour servir à la Connaissance des Crinoïdes vivants.*" is certainly one of the most precious, and justly so from the great interest attached to this topic, partly from the great, one might say, rather painful, minuteness and care with which the author treats every detail of form and structure in the remarkable animal described. He has been successful enough to procure, through the exertions of his son, a great number (seventy-five specimens) of the remarkable small new stalked Sea-lily, discovered by the younger Sars in the abysses of Lofoten (68° north latitude), and now described under the name of *Rhizocrinus Lofotensis*. Four excellently engraved plates are devoted to the illustration of the elaborate description. The memoir is written entirely in French, and it will therefore, perhaps, be thought superfluous to give an abstract of it in this place, the more as it will be easily accessible through the liberality of the University of Christiania, to all societies, etc., which are on exchanging terms with this eminent institution. But as it may perhaps be desirable that the knowledge of the discovery of so remarkable an animal should not be withheld from the readers of this journal, I shall give some notes on it, referring for a more complete account to the excellent work of the learned author itself. This crinoid has principally been taken at depths of from one hundred to three hundred fathoms on the locality stated above, where it appears to live socially. A single dead specimen was found farther to the south, in the bay of Trondjem, at a depth of eighty fathoms. Carpenter and Wyville Thomson have also found it in other parts of the North Sea, and you know that it has been recently recognized that the "*Bourgueticrinus Hotesieri*," from the depths of the Gulf Stream between Florida and Cuba, is in fact a *Rhizocrinus*, and perhaps not specifically distinct from the Norwegian one. This will, however, if the identity should be farther proved, retain its name, as the West Indian Sea-lily was, without any sufficient reasons, referred to the quite indeterminable fossil fragments described by d'Orbigny. The greatest specimen has a length of eighty millimetres, the largest part of which belongs to the stalk, which attains a length of from twelve to seventy millimetres, and consists of from twenty-two to sixty-seven

joints. These joints are distinguished by two points of structure; first, that two articulated, branched "radicles," or "cirri," branch off from the distal extremity of the third to the thirty-second lower joints, and from the very end of the lowest, attaching the stem to various marine objects, fragments of shells, polyzoa, rhizopoda, etc.; secondly, that the joints are connected by true articulations in the manner of the fossil genus *Bourgueticrinus* from the chalk formation, a structure hitherto unknown in any recent Sea-lily, but also found, as shown by Prof. Sars in the stalked "pentacrinoid" stage of *Antedon* (*Alecto*, *Comatula*). There appears, however, to be no voluntary mobility in the stalk, and the purpose of this structure is, probably, only to give it a greater passive flexibility, the lines of articulations alternating regularly at angles approaching to the right angle. The upper joints are the youngest, shorter and thinner, with the exception of the very uppermost (to which the basals are, it appears, ankylosed, or by which they are at least entirely concealed); it is large, obconical, and serves, as in *Bourgueticrinus*, *Apocrinus*, etc., as the base of the calyx, formed by the fourth, fifth, sixth or seventh series of "Radialia," three in each. Of seventy-five specimens, four radii were found in fifteen, five in forty-three, six in fifteen, and seven in two specimens; the radii are only connected together through the soft peristome. The first "radiale" is not visible from without. The third "radiale" wears but a single arm. These arms (whose number is of course from four to seven) are unbranched and built up of twenty-eight to thirty-six joints, connected, two and two, by a double joint (zygygium), and wearing on every second joint a "pinnula" (six to seven, rarely eight, on either side, consisting of eleven to twelve, rarely fifteen joints). The mouth is central, the anal opening short, eccentric, interradial; the peristome of the disc is soft, but strengthened by small, microscopical (from four to seven) perforated plates; five of these are greater than the others, and occupy the angles of the mouth; they are the "oral plates" of the pentacrinoid *Antedon*, disappearing at an early period in the adult. The mouth is provided with twenty (sixteen to twenty-eight) tentacles, longer and shorter, radial and interradial, pinnate, partly studded with spicule, etc., analogous in all respects to those of the arms and flents, and of the ventral furrows from the mouth to the arms; the colored "vesicles," so characteristic of *Antedon*, are nowhere to be found. A double series of scale-like plates closes the furrows, when the tentacles are withdrawn. There are no "pinnules ovales." In a single specimen the three lowermost "pinnulae" showed the incipient swelling of the continuation of the peristome, indicating the beginning and development of the genital organs, and intimating the important fact, that also in this stalked Sea-lily the sexual organs had their place in the pinnula of the arms, as in *Antedon*. (In *Pentacrinus* this fact has not yet been observed.) The single unbranched shape of the arms also confirms the hypothesis of d'Orbigny that the fossil genus *Bourgueticrinus* had simple, undivided arms, and *Rhizocrinus* is on the whole the nearest recent representative of the fossil genus. Also of its evolution something is known, intima-

ting its general accordance with that of *Antedon*. The second part of the memoir and its two last plates are devoted to the development of *Antedon Sarsi*, differing in several interesting particulars from that of *A. rosaceus*, as elucidated by Wyville Thomson and Carpenter. The reader who is acquainted with the extraordinary position of Prof. Sars at the University of Christiania, enabling him to devote himself almost exclusively to scientific pursuits, without being disturbed by the professional duties incumbent on most other scientific men, as curators of museums, lecturers, etc., will acknowledge the zeal and energy with which the author, though in a somewhat advanced age, continues his scientific work, as well as the enlightened liberality of the Representation, who did not hesitate to give an unusual position to a man capable of doing unusual work.

In the "Proceedings of the Academy of Christiania," for 1867, of which I was formerly only capable of giving an incomplete report, you will find some contributions to the geology of Norway (among which a paper by F. Dahl, announcing the discovery of gold and coal, probably Jurassic, in Finnmarken, both however apparently not under such circumstances that the discovery can have any practical value), and a discussion about the theory proposed by Prof. Schybeler, that the short time in which the corn plants and other vegetables succeed in ripening their fruits in that northern country, is due partly to the clearness of the nights, the influence of light compensating to a certain degree for the want of heat; but a paper that has a more direct interest for North American readers, is Prof. Sars' "Determinations of a Series of Scottish and North American Glacial Shells and other remains." The Scottish collection embraced fifty species, principally from the Clyde district, of which thirty-three are also found in the glacial and fourteen in the post-glacial beds of Norway; the North American series collected by Dr. Packard, in Maine, Canada and Labrador, consisted of twenty-nine species, twenty-one of which are known from the Norwegian formations, while of the rest three or four are found in the British beds, the remaining four (*Cardita borealis*, *Pandora trilineata*,* *Thracia Conradi*, and *Aporrhais occidentalis*) are not known from this side of the Atlantic, neither in the fossil nor the recent state.—Copenhagen.

NATURAL HISTORY MISCELLANY.

ZOÖLOGY.

NEW FINNER WHALE.—The Academy of Natural Sciences has just obtained the perfect skeleton of a whale from the coast of Maryland. It is a finner, of the genus *Sibbaldius* Gray, and is half-grown and forty-

* This was wrongly determined; it is the *Pandora arctica*, a circumpolar species.—A. S. P.

seven feet in length. It is quite distinct from all known species, but is nearest *S. laticeps*. Its characters are found in the nasal and phryngoid bones, and in the cervical vertebrae, etc. I call it *S. tectirostris*. Two cervicals only have complete lateral canals; the nasals are short, wide, concave in front, except a prolonged keel in the middle line above, and in front.—EDWARD D. COPE, *Philadelphia*.

THE CORAL SNAKE.—In the March number of the *NATURALIST*, pages 36 and 39, Mr. Dall has given an amusing (?) account of his bravado in handling a snake, reputed to be very poisonous by the natives of Nicaragua, and called the "coral snake," which Mr. Dall calls "*Elaps? euryxanthus* Ken.," and says it is "perfectly harmless." It is well known that the genus *Elaps*, which includes a large number of species in tropical countries, all of them banded with bright colors, is closely allied to the notorious asp and viper of the old world, and that, like those deadly species, it is provided with grooved poison fangs, which are, however, quite small and inconspicuous in *Elaps*. We have received several species of *Elaps*, both from the East Indies and tropical America, under the name of "coral snake," and with memoranda stating the deadly character of its bite.

Now since Mr. Dall does not appear to know whether his "coral snake" is an *Elaps* or not, his foolhardiness in handling a snake having such a reputation becomes ridiculous. Of course his snake may have been harmless, and not an *Elaps*, since there are harmless genera so closely resembling *Elaps* as to be indistinguishable by external appearances, but Mr. Dall has not shown that his snake was of this sort, and by placing it in "*Elaps?*" would indicate the contrary.

It may, therefore, safely be said that the only sensible course for strangers to follow, be they naturalists or others, is to avoid unnecessarily exposing themselves to the bites of serpents reputed venomous by the natives of tropical countries.—A. E. VERRILL, *Yale College*.

NORTH ATLANTIC DREDGING EXPEDITION.—The Royal Society has applied to the Admiralty for the use of a steamer in order to continue the investigations so ably commenced by Dr. Carpenter and Prof. Wyville Thompson; and the "Porcupine" has been placed at their disposal. The expedition will take place about the middle of May, and the deep water, from 1100 to 1300 fathoms, near the Rockall Bank, will be the first explored, and afterwards the sea bottom lying off the outer Hebrides and the Shetland Isles.—*Annals of Natural History*.

HEARING OF CRABS.—We do not yet thoroughly understand how they [Crustacea] see, smell, or hear; nor are entomologists entirely agreed as to the function or the structure of the antennæ. This interesting subject offers a most promising field for study, and I would particularly call the attention of entomologists to a remarkable memoir, by Hensen, on the auditory organ in the decapod Crustacea. Hensen has shown that the [supposed] otolithes in the open auditory sacs of shrimps are foreign particles of sand, *introduced into the organ by the animal itself*. He proved

this very ingeniously by placing a shrimp in filtered water without any sand, but with crystals of uric acid. Three hours after the animal had moulted, he found that the sacs contained many of these crystals. M. Hensen has also shown that each hair in the auditory sac is susceptible of being thrown into vibration by a particular note, which is probably determined by the length and thickness of the hair. It may be experimentally shown that certain sounds throw particular hairs into rapid vibration, while those around them remain perfectly still.—*Sir John Lubbock in Scientific Opinion.*

A BOX TURTLE IN WINTER.—On February 4th, a large Box Turtle (*Cistudo Virginica*) was unearthed while digging in the barn-yard, and brought in, and is at present an inmate of the family,—on mild days travelling over the carpets at a pretty good rate of speed, and at other times taking refuge in dark corners and beneath furniture. Sometimes he is missing, and a grand turtle hunt ensues. We have consulted White's "Selborne," and have hopes of making an "old family tortoise" out of this one. He is a convenient pet now, not requiring to be fed, and is protected from an inadvertent footstep by his armor.—Mrs. V. W., *Rye, N. Y.*

A DOE WITH HORNS.—A young man recently shot a deer of splendid proportions, and carrying a beautiful pair of antlers, each with four branches. It proved to be a doe, and hundreds have since seen it who will attest its sex, none of whom ever before saw a doe with such a *neck and horns*. It lies daily in front of the door next to my office, waiting for a bid from Barnum. Can you inform me whether this is a new fact in natural history or not?—L. P. HATCH, *Minneapolis, Minn.*

[We have never heard of a female deer assuming the characters of a male before, but it is well established that female birds, living to old age, often assume the plumage, and to a certain extent the habits of the male. In the Museum of the Academy there is a Pea-hen, that in the spring before her death, at the age of nineteen years, changed her dull female plumage for the bright plumage and full train of the male bird. N. Vickery, Taxidermist, of Lynn, has the specimen mounted.—EDS.]

FAMILIARITY OF A WEASEL.—Three times during the month of January last, a weasel came from a pile of logs, and advanced towards a man who was cutting wood in the vicinity, and played about him, quite regardless of the presence of spectators and not disturbed by their conversation. The animal was of a reddish brown color, with a pure white breast.—MRS. V. W., *Rye, N. Y.*

FOSSIL JELLY-FISHES.—M. Haeckel has described some fossil jelly-fishes belonging to the groups Discophora and Rhizostomida, from the Jurassic, etc., lithographic slates at Eichstadt.—*Cosmos.*

ALBINO ROBINS.—Two albinos of the robin were presented to the Buffalo Society of Natural History last autumn. Both were shot near that city.—CHARLES LINDEN.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

THE WORCESTER LYCEUM AND NATURAL HISTORY ASSOCIATION.—The annual meeting of this association was held on Wednesday, May 5, 1869. The different reports read indicated that the society was in a very flourishing condition, and that its efforts to make a good cabinet of specimens had been quite successful.

A committee on Field Meetings was chosen, with the President as chairman, and a determination was manifest on the part of all present to make the meetings interesting and profitable to members and the public. Nathaniel Paine was elected President, with an able corps of officers.

ANSWERS TO CORRESPONDENTS.

E. A. S., Grand Rapids, Mich.—Your drawing appears to be that of *Papilio Marcellus*.

W. G. B., Salem.—*Cynthia Lavinia* Harr. is a very rare butterfly throughout New England. Dr. Harris's specimen was taken in Milton. Mr. Scudder reports a specimen from Cape Cod. You say you have captured one in Hamilton, and we are informed that Mr. Bennett, of Holyoke, has found one in his neighborhood. Out of Massachusetts it has been taken at Hampton, N. H., and is occasionally seen in Connecticut. Its proper home is farther south.—S. H. S.

W. W. B., Providence, R. I.—The Index to Vol. I. has not yet been printed.

B. S. M., Oiney, Pa.—The Saw-flies are probably *Selandria rosea*. An account of it is given in Packard's "Guide to the Study of Insects," p. 223, and in Harris's "Treatise on Injurious Insects."

S. M. M., Mauch Chunk, Pa.—It would be impossible to give the names of the birds from your descriptions. Send us skins by mail, and we will identify them for you.

BOOKS RECEIVED.

Journal for the Diffusion of Natural Science. Third Series. Vol. I, No. 2. Copenhagen, 1869.

Farm Implements and Farm Machinery, and the Principles of their construction and use. With 287 illustrations. By John J. Thomas. New York: Orange Judd & Co. 12mo, pp. 302. Price \$1.50.

A Synopsis of the Birds of the Hawaiian Islands. By S. B. Dole. 8vo, pp. 16. Boston, 1869.

Notes on the Eruption of the Hawaiian Volcanoes, 1868. By W. T. Brigham. 4to, pp. 23. Boston, 1869.

Four New Genera of Hawaiian Plants. Notes on *Hesperomea* by W. T. Brigham, and on *Alsinidendron*, *Phyloderma*, and *Brighamia*, with an Analysis of the Hawaiian Flora by Horace Mann. Boston, 1869. 4to, pp. 14, four plates.

Parsons on the Rose: A Treatise on the Propagation, Culture, and History of the Rose. By Samuel B. Parsons. New and revised edition, Illustrated. New York: Orange Judd & Co. \$1.50.

The Mississippi Valley: Its Physical Geography, including sketches of the Topography, Botany, etc. By J. W. Foster, LL. D. Illustrated by maps and sections. Chicago: S. C. Gregg & Co. 1869. 8vo, pp. 443. \$3.50.

The Practical Poultry Keeper: A complete and standard Guide to the Management of Poultry. By L. Wright. Third edition, Illustrated. New York: Orange Judd & Co. 12mo, pp. 243. \$2.00.

Fishing in American Waters. By G. C. Scott. Illustrated. Harper Brothers, New York, 1869. 12mo, pp. 485.

Le Naturaliste Canadien. May.

Popular Science Review. April. London.

Occasional Papers of the Boston Society of Natural History. I. Entomological Correspondence of T. W. Harris, M. D. Edited by S. H. Scudder. 8vo, pp. 375. Portrait, four plates, forty-six cuts, \$5. Published by the Society, and for sale by the Naturalist's Book Agency.

Bulletin of the National Association of Wool Manufacturers. April, 1869. Boston. 8vo.

